

UNCLASSIFIED

AD NUMBER

AD044574

CLASSIFICATION CHANGES

TO: unclassified

FROM: confidential

LIMITATION CHANGES

TO:
Approved for public release; distribution is unlimited.

FROM:
Distribution: Further dissemination only as directed by Office of Naval Research, Attn: Code 466, One Liberty Center, 875 North Randolph Street, Arlington, VA 22203-1995, 31 AUG 1954, or higher DoD authority.

AUTHORITY

ONR ltr dtd 29 Mar 1960; ONR ltr dtd 29 Mar 1960

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD _____

*Reproduced
by the*

**ARMED SERVICES TECHNICAL INFORMATION AGENCY
ARLINGTON HALL STATION
ARLINGTON 12, VIRGINIA**



**DOWNGRADED AT 3 YEAR INTERVALS:
DECLASSIFIED AFTER 12 YEARS
DOD DIR 5200.10**

UNCLASSIFIED

Armed Services Technical Information Agency

AD

44574

NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

Reproduced by
DOCUMENT SERVICE CENTER
KNOTT BLDG DAYTON OHIO

THIS REPORT HAS BEEN DELIMITED
AND CLEARED FOR PUBLIC RELEASE
UNDER DOD DIRECTIVE 5200.20 AND
NO RESTRICTIONS ARE IMPOSED UPON
ITS USE AND DISCLOSURE.

DISTRIBUTION STATEMENT A

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED.

NOTICE: THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE
NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING
OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 and 794.
THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN
ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

AD No. 577
ASTIA FILE COPY

~~CONFIDENTIAL~~

Columbia University in the City of New York

009

HUDSON LABORATORIES

DOBBS FERRY, N. Y.

PROJECT MICHAEL



RESEARCH SPONSORED BY
OFFICE OF NAVAL RESEARCH

Reproduction of this
document is prohibited
Per _____

CONTRACT N6-ONR-27135

54AA

67621

NOV 8 1954

This document has been selected in accordance with
OPNAVLET 10-11-54. The security
classification is to be maintained in effect.



Date: _____
_____ at _____
_____ of Naval Research Code _____

~~CONFIDENTIAL~~

COLUMBIA UNIVERSITY
Hudson Laboratories
Dobbs Ferry, N. Y.

PROJECT MICHAEL
Contract N6-ONR-27135

W. A. Nierenberg
Director

Technical Report No. 3C
Behavior of M.A.C. Mints on the
Bottom of the Hudson River

by

Roberto Frassetto

Research Sponsored by
Office of Naval Research

Further distribution of this report, or of an abstract
or reproductions, may be made only with the approval of
Chief of Naval Research (Code 486).

Copy No. 009

CONFIDENTIAL

of 75 Copies

August 31, 1954

This report consists of 7 pages

This document contains information affecting the national
defense of the United States within the meaning of the
Espionage Laws, Title 18, U.S.C., Sections 793 and 794.
The transmission or the revelation of its contents in any
manner to an unauthorized person is prohibited by law.

544A

67621

CONFIDENTIAL

BEHAVIOR OF M.A.C. MINTS ON THE BOTTOM
OF THE HUDSON RIVER

by

Roberto Frassetto

A number of mints 2 ft in diameter and 7 in. tall (photo 1) were furnished to the Hudson Laboratories by the Mine Advisory Committee to be laid on the bottom of the Hudson River in order to study their behavior when exposed to the current.

Five mints were placed on a square field about 9 ft wide in a pattern similar to the number 5 on a die, the minimum space between mints being 3 ft.

Divers of our laboratory using aqualungs, self-contained breathing apparatus, laid the mints on a hard bottom section of the river with the aid of a metal spider built for that purpose. In fifty-five days of exposure to erratic tide currents, which reached a measured maximum of two knots at the bottom, the mints did not move from their positions and were not buried under the sand. Barnacles and vegetation grew on the mints, as shown in photographs 1 and 2.

Because of the current, the very short time of slack tide, and the poor underwater visibility (from 6 to 12 in.), a device was necessary to help the divers in laying the mints on a precisely measured pattern at a given orientation to the current. Previous experience of the writer at the Beavertail Laboratory showed that the laying of mints on an exactly measured pattern was not easy even when the underwater visibility was about 10 ft. The presence of a fixed reference point at the bottom that would not be lost, as in the case at Beavertail, would be essential to enable the divers to check within inches the position of the mints relatively to the field position and relatively to each other, after several days of water current exposure.

The reference consisted of a spider constructed of metal tubing which could be anchored firmly to the bottom but would not interfere with the mints in case they drifted with the current. The spider (See Fig. 1) had four horizontal arms, each about 9 ft long, and with vertical legs 3 1/2 ft long on the outer end of each arm.

The location of the mint field was marked by a float fastened with a line to the spider. Later a metal wire was used from spider to shore as the float was lost, probably stolen by week-end boaters cruising in the area. Before laying the mints, several convenient areas of the river were explored in order to find a suitable location. Samples of bottom were

taken to be sure the area selected would have a sand and gravel bottom. A hard bottom was selected with the assumption that on such a bottom the mints would have the poorest conditions for holding their positions under the pressure of water currents. It was assumed that on a muddy bottom the mints would sink and be anchored by the mud, thus having less likelihood of drifting.

On July 1 the five mints fastened to the spider with marline in the desired pattern were lowered to the bottom with the spider oriented with one side normal to the current. The writer and Mr. M. Hall dived after the array and hammered the legs of the spider a few inches into the bottom to be sure it would grip the sand firmly. The lines holding the mints were then cut and the mints dropped 3 ft to the bottom. Their positions relative to the marked points on the spider were corrected by hand since the mints travel a few inches horizontally while dropping because of a current of seven tenths of a knot.

On July 8 and 15, and August 24, inspection of the mints was made by feel because the underwater visibility was only 6 in. This inspection revealed that the mints had not moved from their original locations. The inspection was easy and accurate because of the presence of the spider and its reference points.

The water current was measured on three occasions, July 8, 9, and 12, using a Price current meter. The tide current, which at the surface was generally about 30% stronger, reached a maximum of about 2 knots at the bottom.

At the last inspection made by the divers on August 24, the bases of the mints were surrounded by gravel but were not sunk into the sand. The upper parts of the mints were well covered with barnacles and vegetation. The mint at the center of the field was recovered to be photographed and it is shown in both of the included photographs taken at different views.

It was decided to leave the remaining four units at the bottom of the river, under the spider, in case a request is made to inspect this field after a long period of time has elapsed. This inspection will be made only if requested by interested agencies, possibly during the summer of 1955.

hir

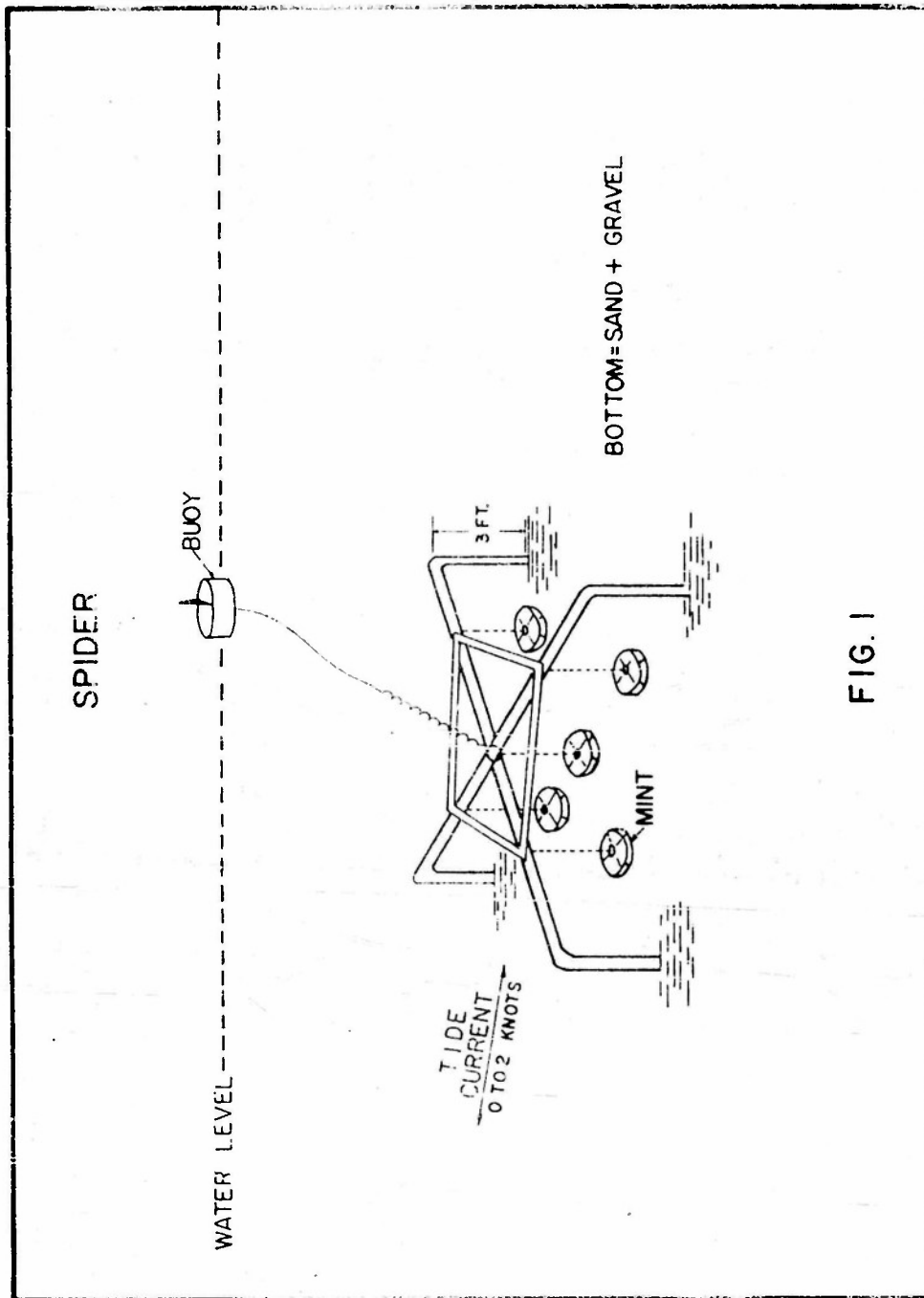
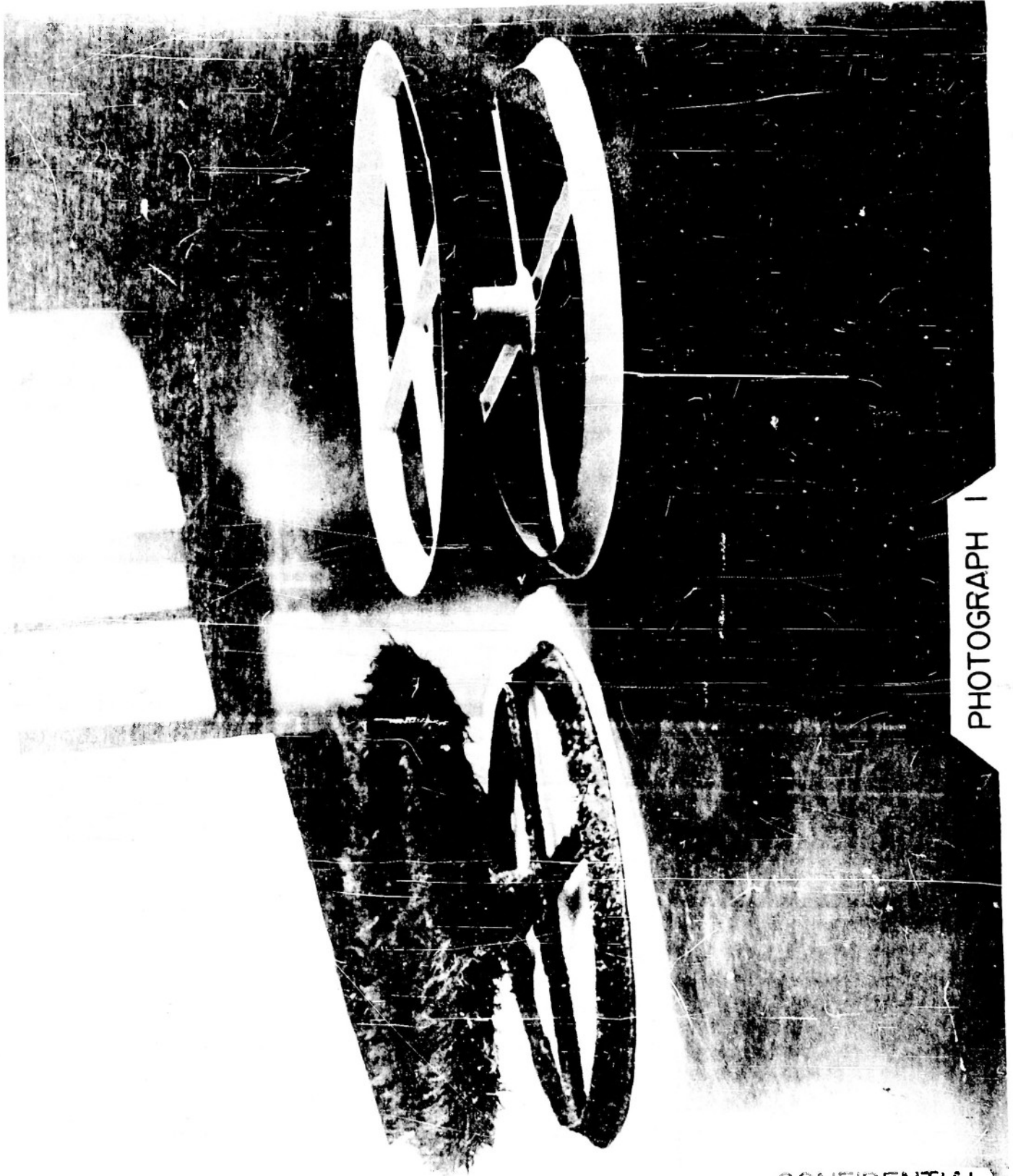


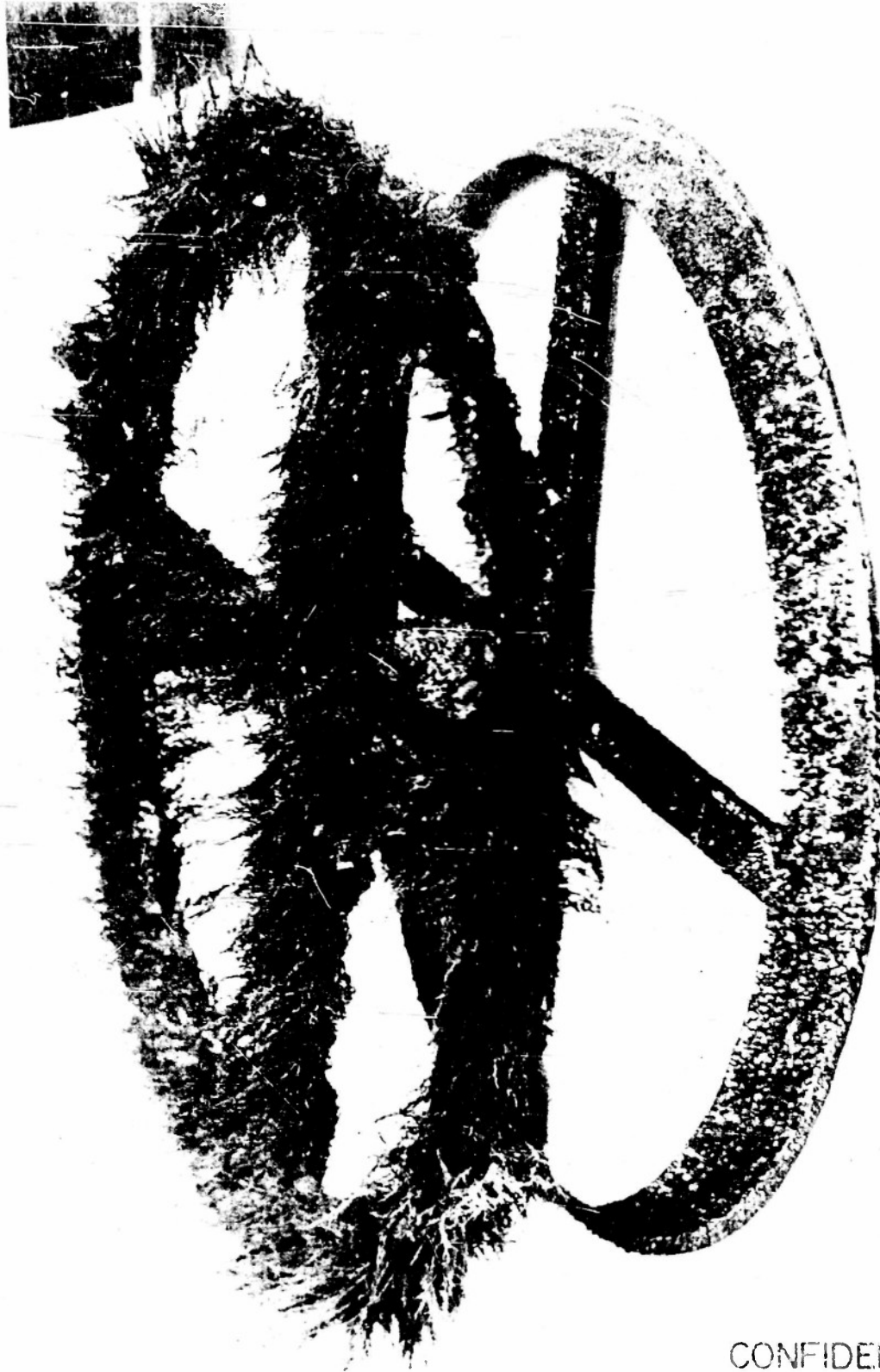
FIG. 1



PHOTOGRAPH 1

CONFIDENTIAL

- 8 -



PHOTOGRAPH 2

CONFIDENTIAL

UNCLASSIFIED

UNCLASSIFIED